California Water Plan – Update 2013

Breakout Session: Groundwater

Groundwater in Integrated Water Management

October 25, 2011

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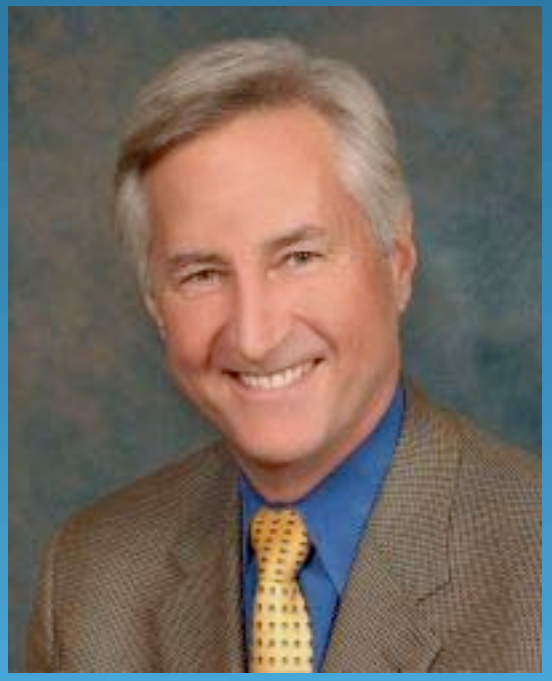
Groundwater Resources Association of California
Parker Groundwater, Inc.

"When the well's dry, we know the worth of water."
Benjamin Franklin, Poor Richard's Almanac 1746

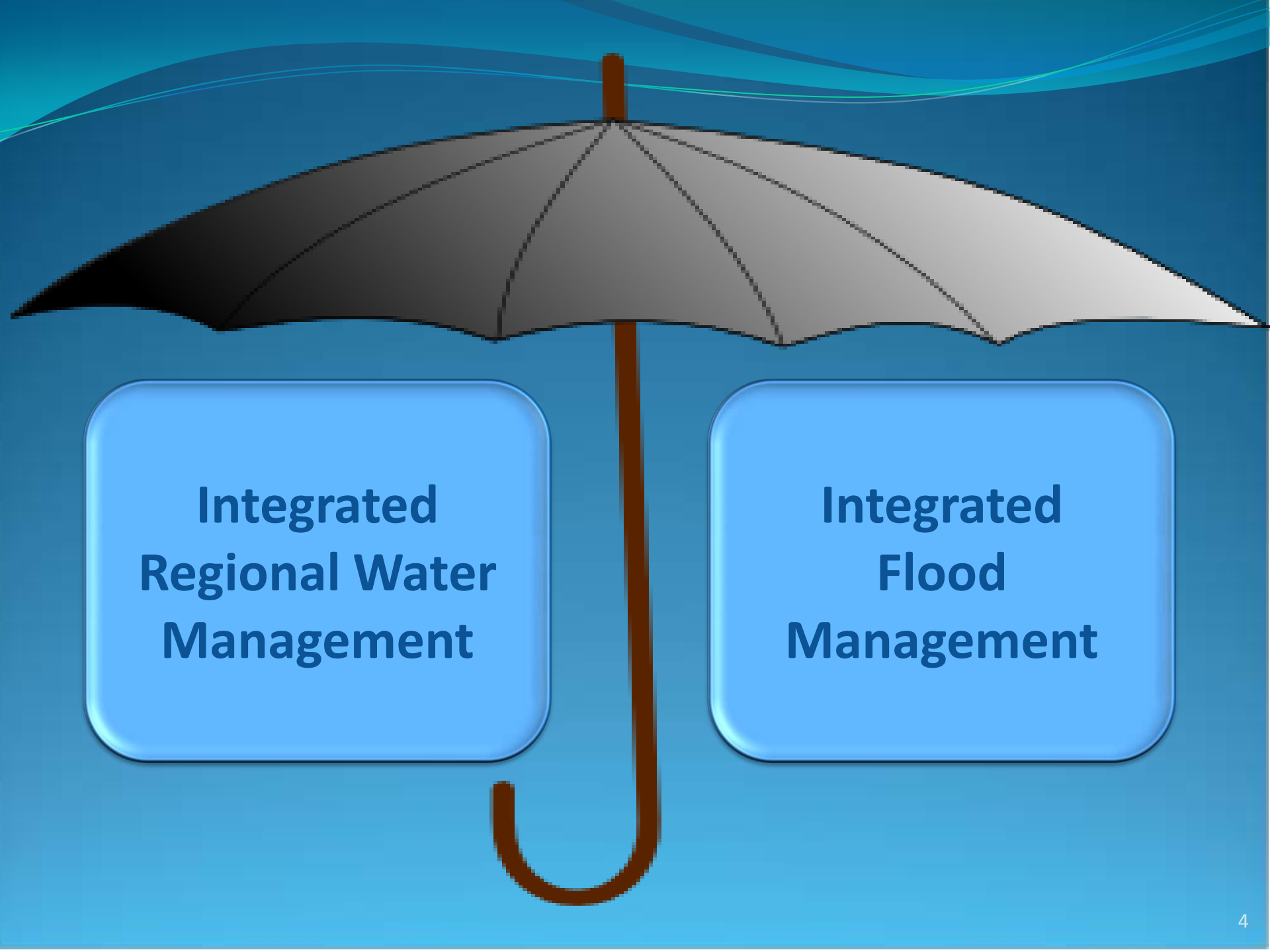
Integrated Water Management on the Web



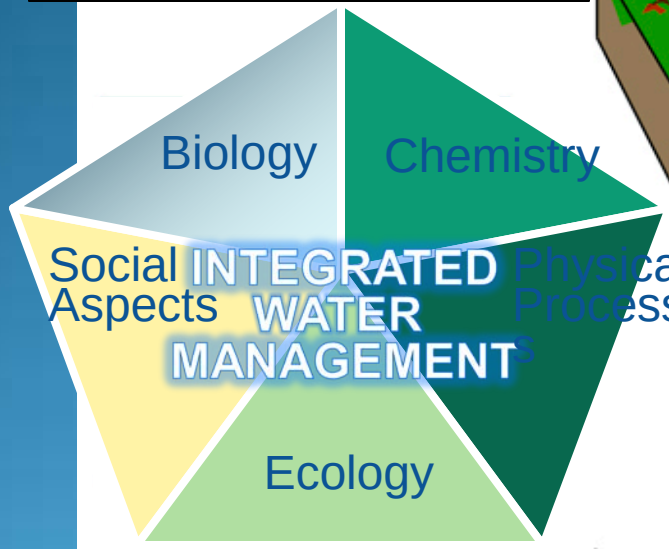
Requires Leadership at the State Level

Integrated Water Management

- Multifaceted, multidisciplinary
- Approaches water management at all fronts on many levels, regionally and statewide
- Multiple benefits and uses
- Various resource management strategies for sustainability
- Weighs risks of uncertain futures


Integrated Regional Water Management
Integrated Flood Management

Integrated Water Management

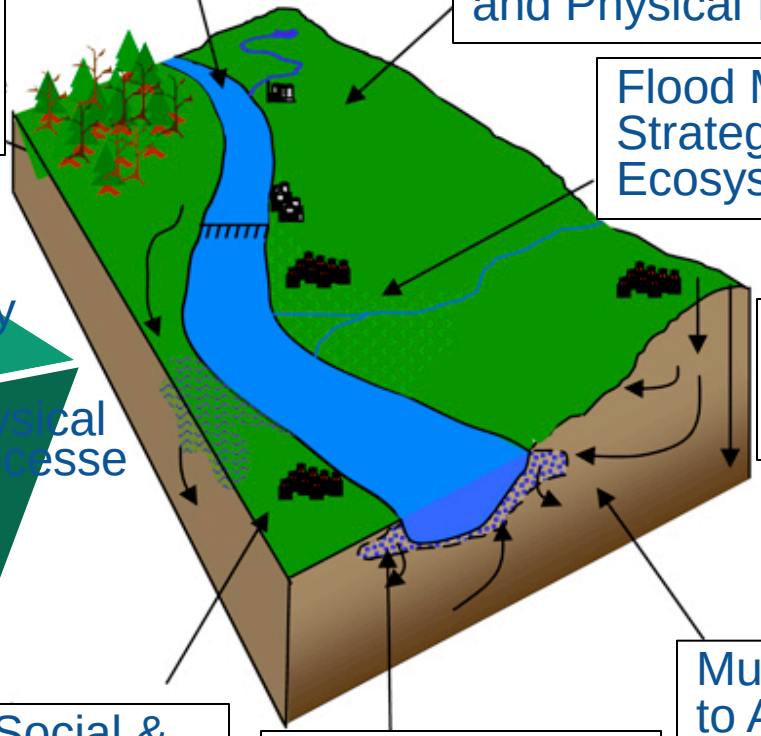


Anthropogenic Impacts to Aquatic Biota

Catchment Connectivity and Physical Processes

Role of Development & Fragmentation in Ecosystem Restoration

Flood Management Strategies and Ecosystem Reponses



Pollutant Pathway Fate & Transport Hydrologic Modeling

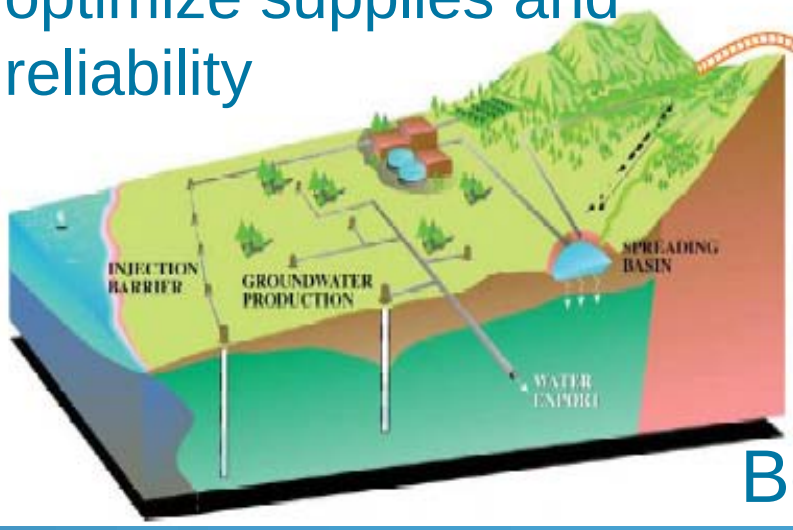
Multi-Tracer Approach to Assess GW Pollution

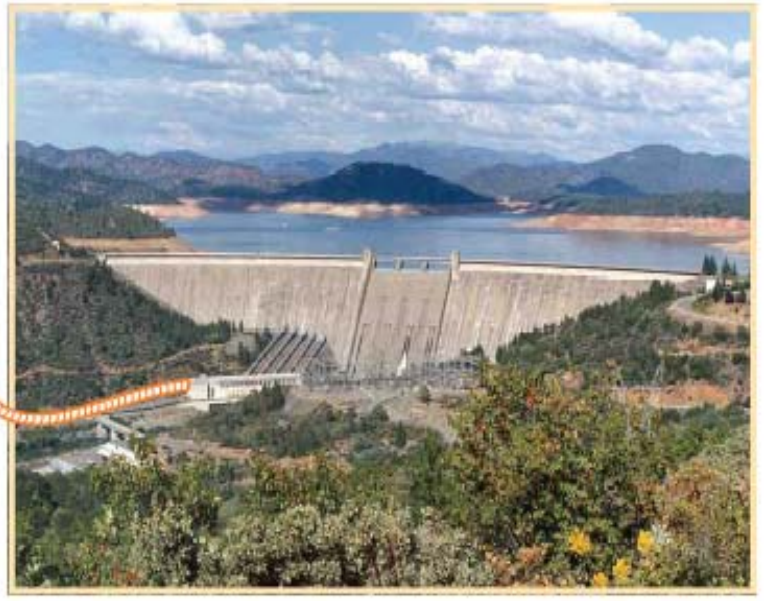
Policy Role in Social & Economic Change Towards Sustainability

Natural Variation & Anthropogenic Effects on Hyporheic Zone

Conjunctive Water Management

Coordinated management of surface water and groundwater resources to optimize supplies and reliability



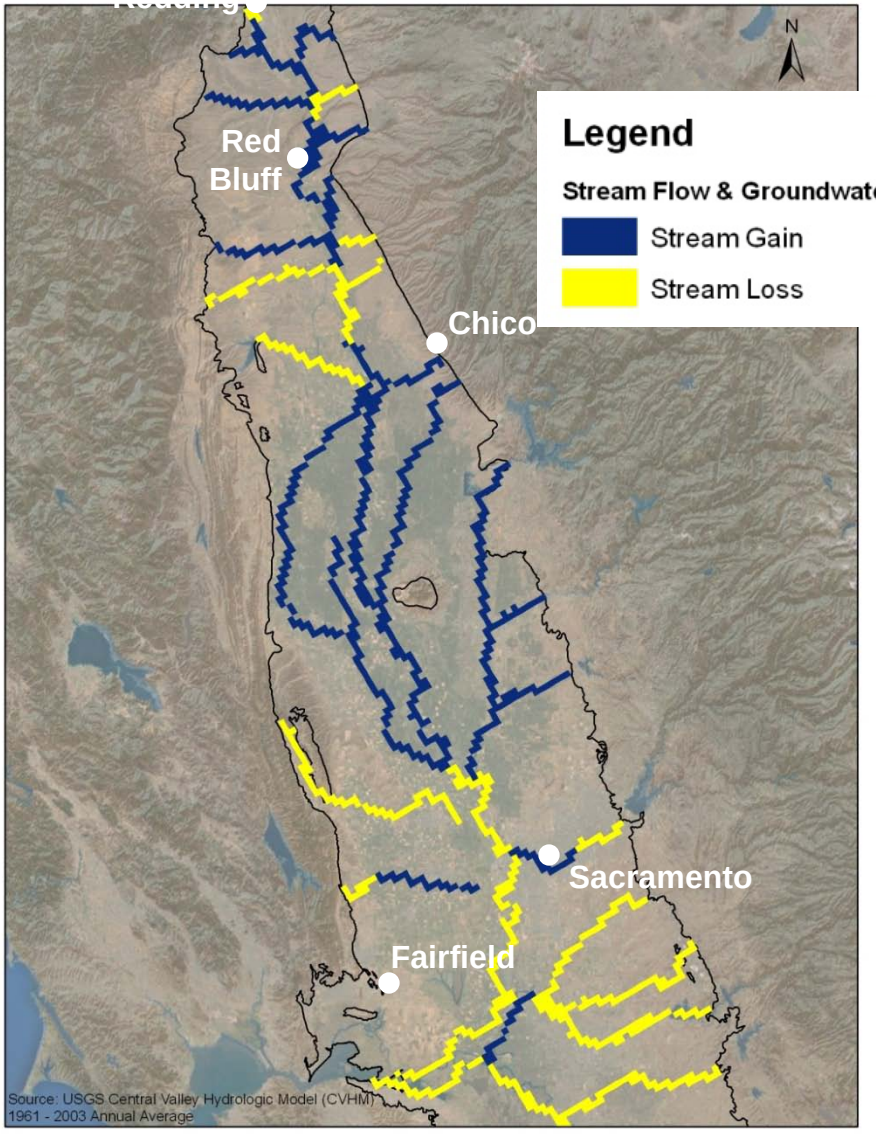


Benefits include:

- Environmental enhancements = increased flows, improved habitats, groundwater dependent ecosystem resiliency
- Reduced overdraft, subsidence and saline intrusion

Courtesy TNC

Connection Is Everywhere



Gaining and Losing Reaches of Rivers and Channels of the Sacramento Valley

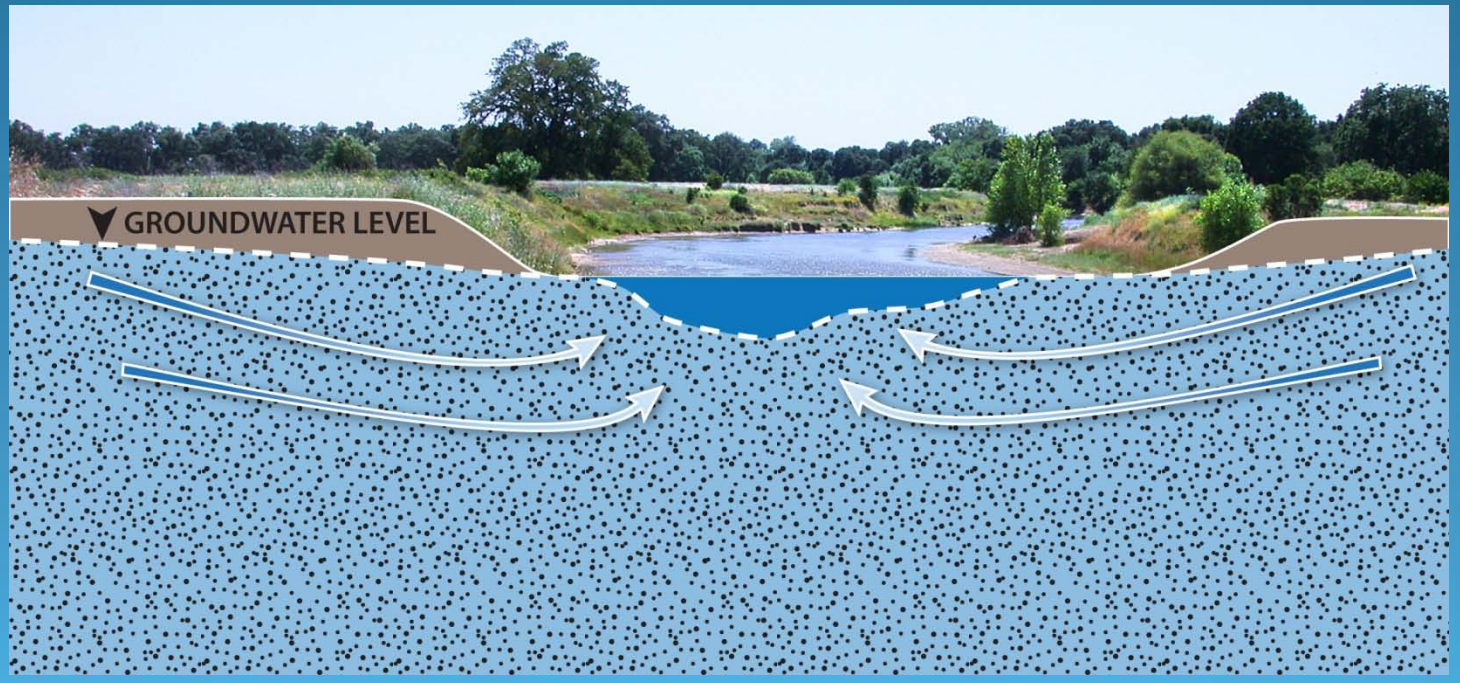
Source: *USGS Central Valley Hydrologic Model (CVHM)*
Values are Average Annual Volumes for 1961 – 2003
Units in Acre-feet per year

Courtesy TNC

Surface Water - Groundwater Connection

Groundwater Affects Stream Flow

"Gaining Stream"



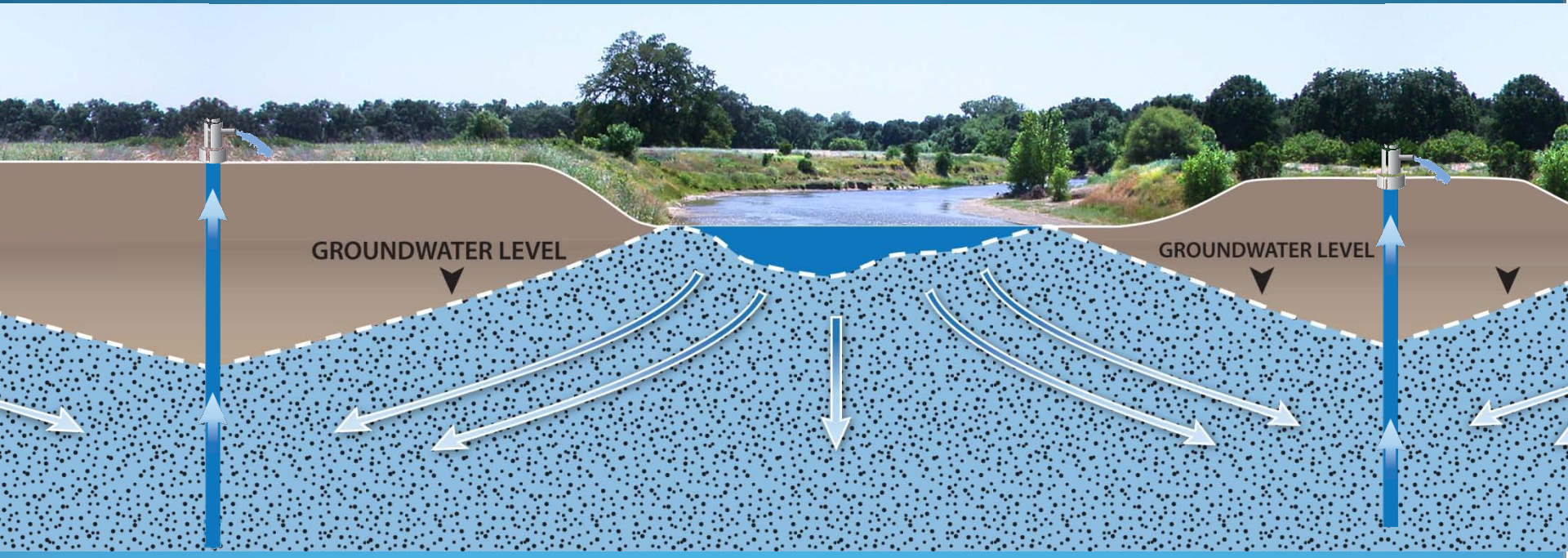
High Groundwater Levels - Groundwater Maintains Stream Flow & Stabilize Surface Water Temperatures

Courtesy TNC

Surface Water - Groundwater Connection

Groundwater Affects Stream Flow

"Losing Stream"



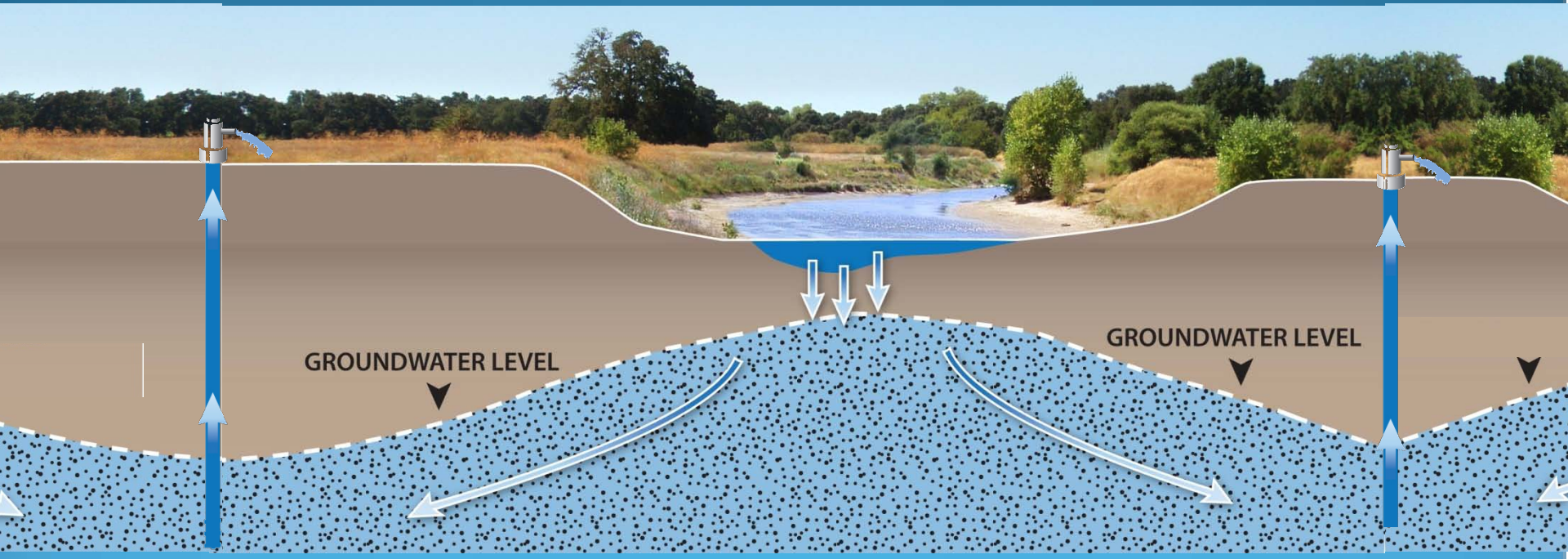
Pumping Lowers Groundwater Levels - Stream Loses Flow to Groundwater

Courtesy TNC

Surface Water - Groundwater Connection

Groundwater Affects Stream Flow

Groundwater Levels Below Stream Channel "Losing Stream"



Pumping Lowers Groundwater Levels - Stream Loses Flow to Groundwater

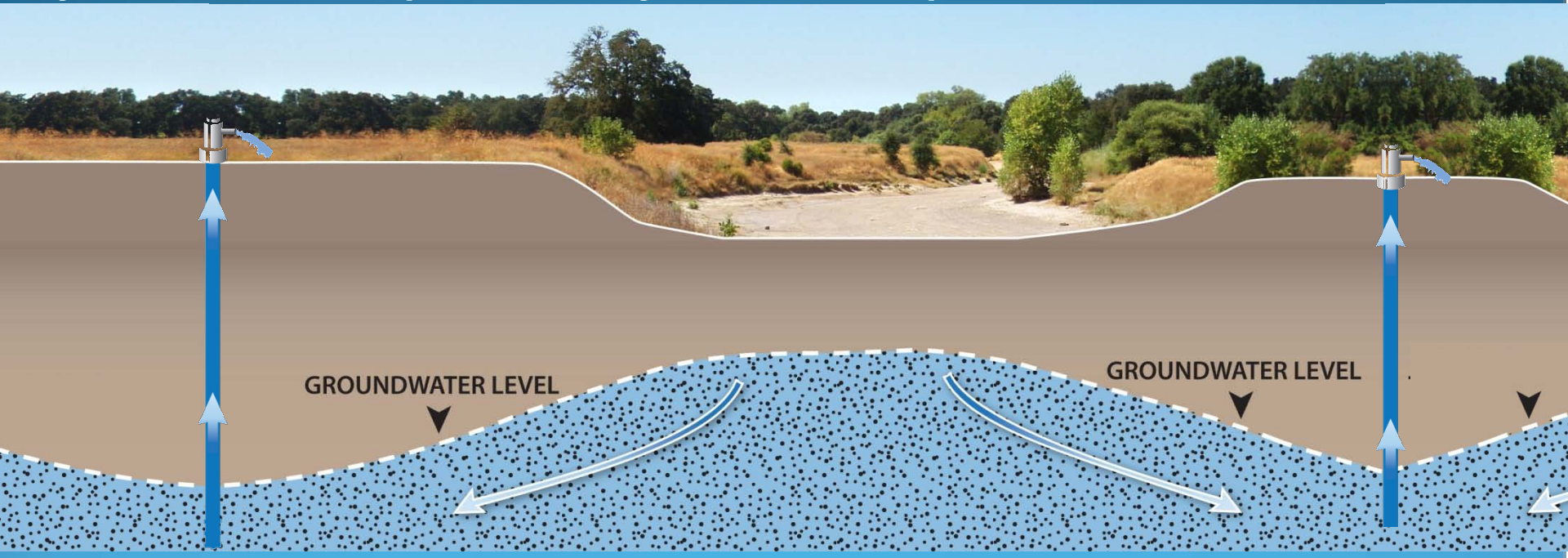
Courtesy TNC

Surface Water - Groundwater Connection

Groundwater Affects Stream Flow

Seepage to Groundwater Exceeds Stream Flow
Dry Stream Channel (Intermittently or Year-round)

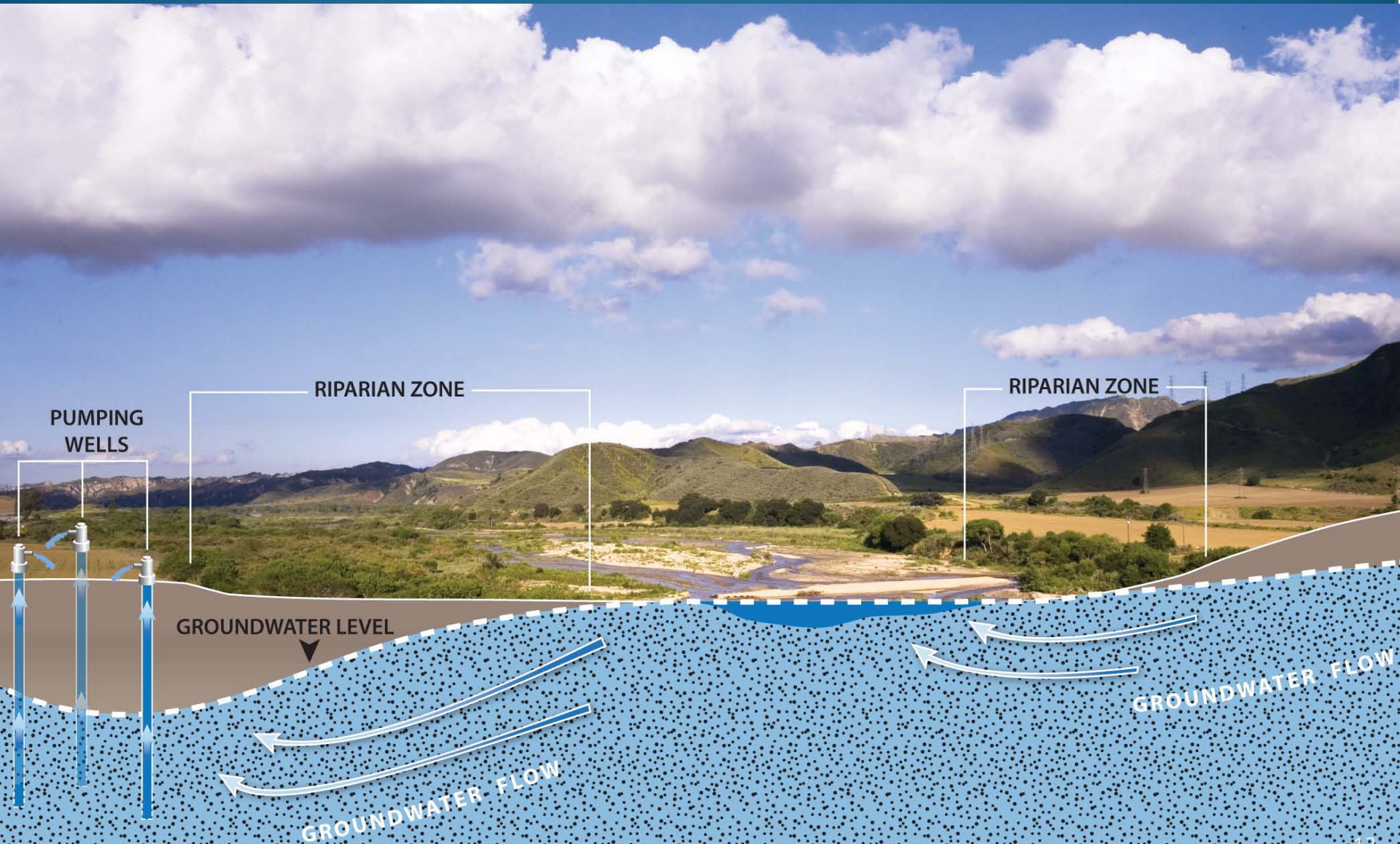
"Ephemeral Stream"



Pumping Lowers Groundwater Levels - Stream Loses Flow to Groundwater

Courtesy TNC

Dynamic Systems



Conclusions: Groundwater in Integrated Water Management

- Multiple benefits and strategies
- Everything is connected to everything else*
- Groundwater can provide storage, supply reliability, and environmental benefits
- Changes in surface water & groundwater flows and quality effect one another and ecosystems
- There will always be trade-offs
- There is no such thing as a free lunch*
- Thanks to The Nature Conservancy (slides 7-12)

*Barry Commoner